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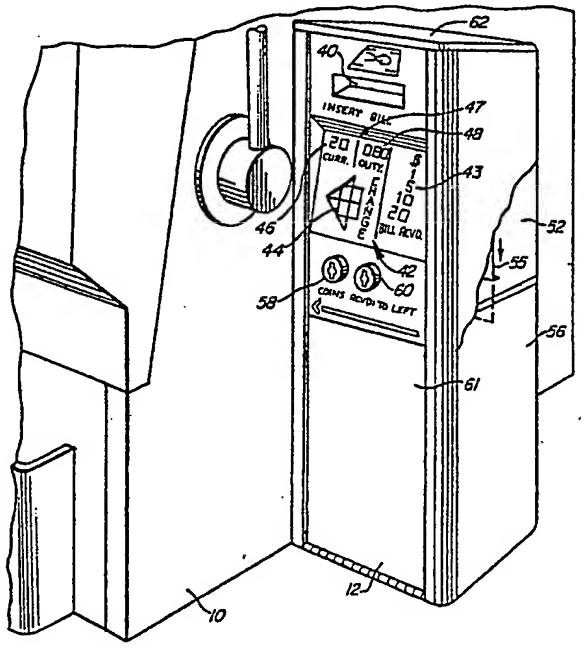
GB 1484858
GB 1424775
GB 1235651
GB 1227522

(58) Field of search
G4V
G4X
Selected US specifications from IPC sub-class G07D

(54) Bill validation and change system for a slot machine

(57) In a slot machine gaming device which is provided with means for accepting and storing coins to play a game, means for determining a winning game play and means for paying out coins for a winning game, there is provided a currency bill changing means. The bill changing means includes its own bill receiving and validating device, but gives coins in change for accepted bills through the paying out means of the gaming device. Thus change given for the currency bill is always in coins of a denomination used by the slot machine, and interlocks can be provided between the slot machine gaming device and the bill changing means, to prevent use of the slot machine while change is being sought.

FIG. 2



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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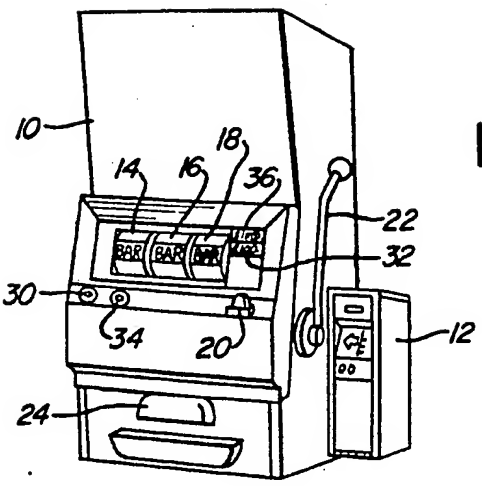
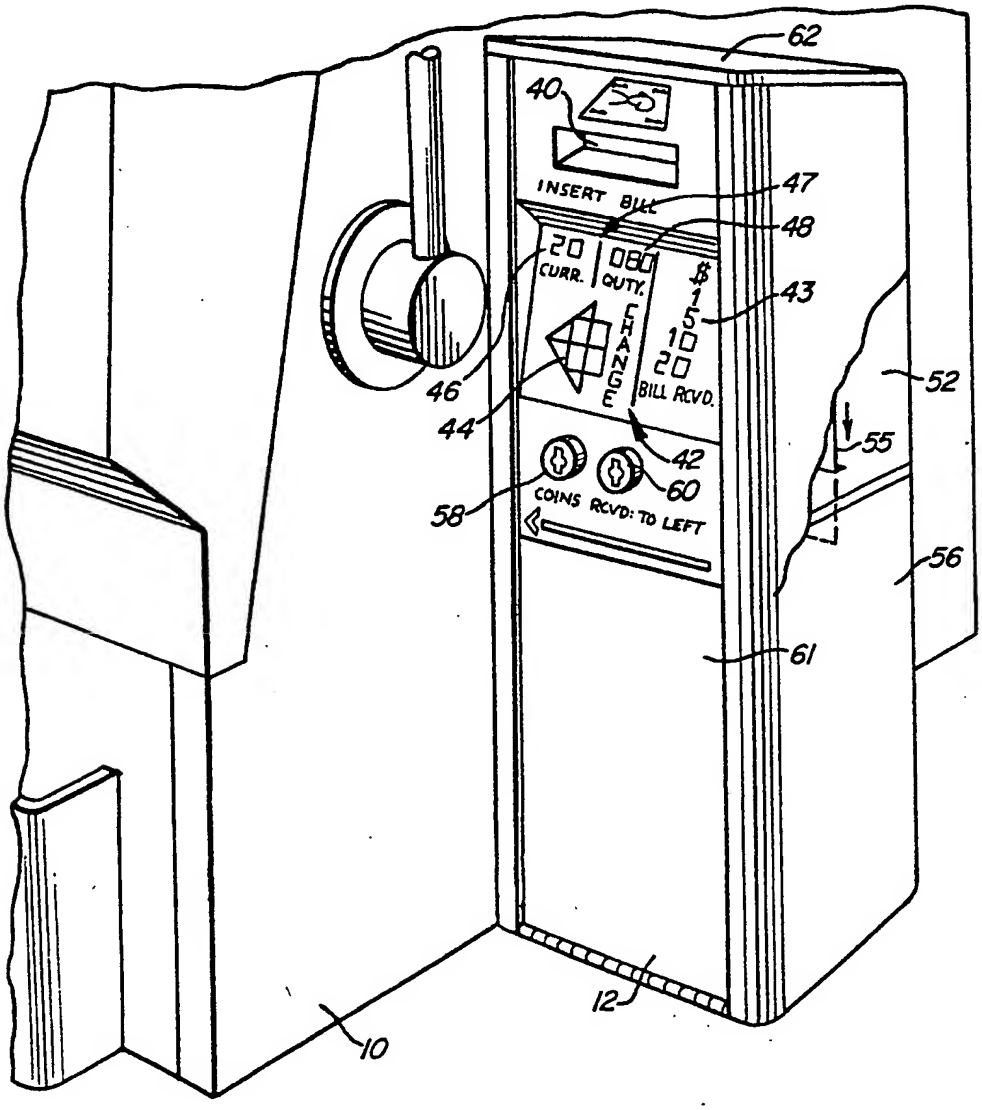

10
14
16
18
36
22
32
30
34
20
12
24

FIG. 1

FIG. 2


62
40
INSERT BILL
47
48
20
CURR.
080
QUTY.
CHANGE
$
1
5
10
20
BILL RCVD.
43
46
44
52
55
42
60
58
COINS RCVD: TO LEFT
56
61
12
10

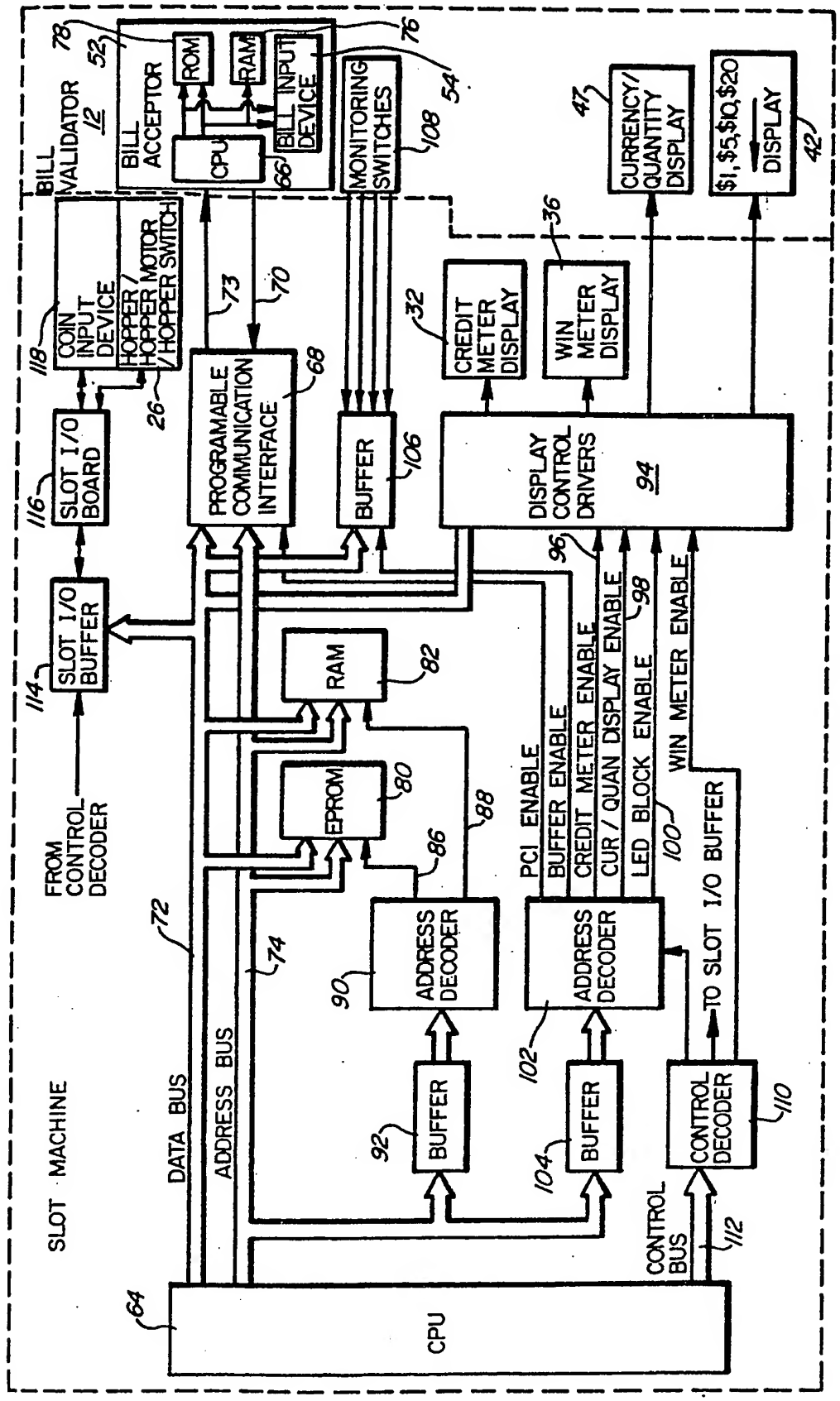
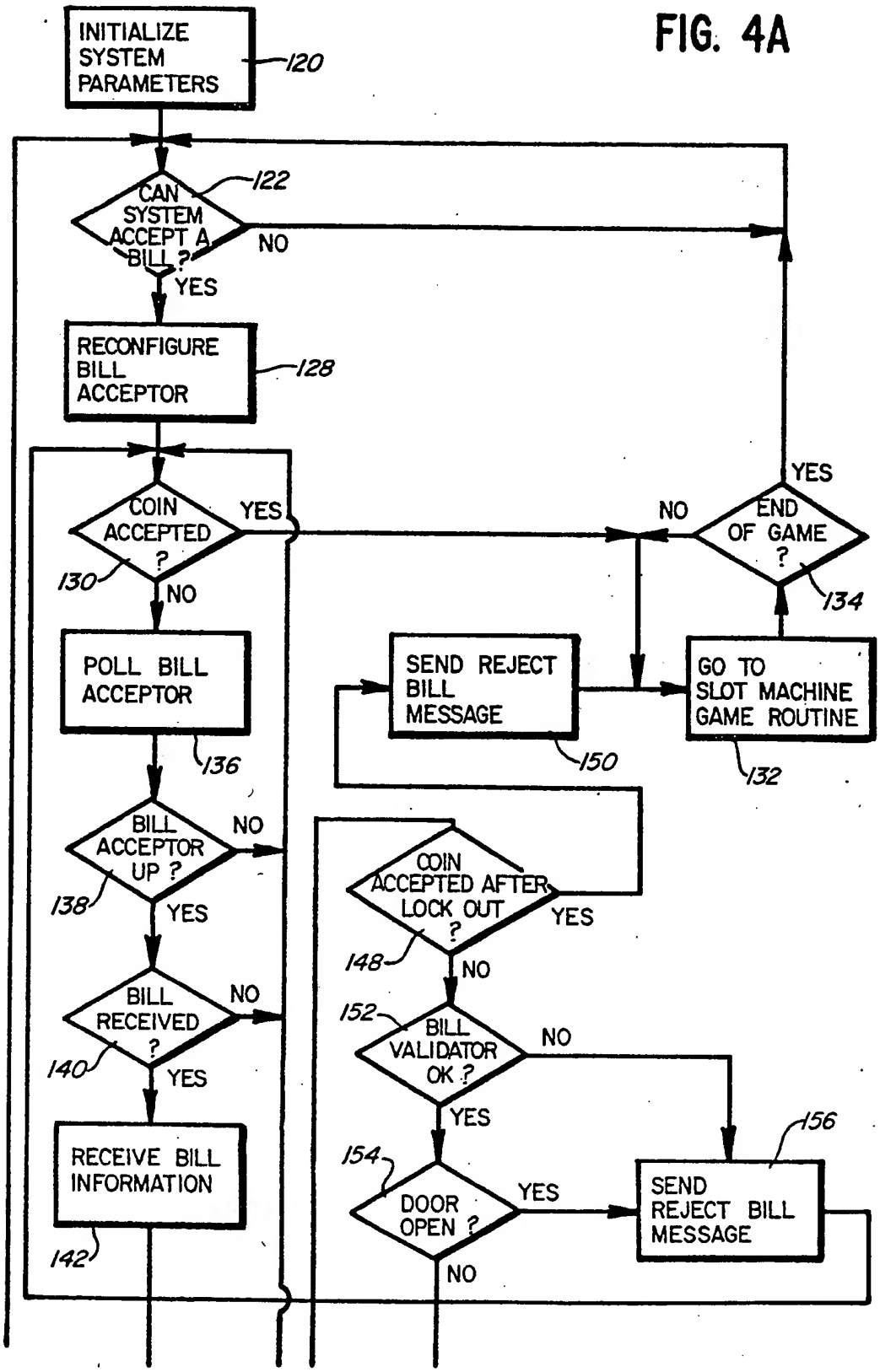

BILL VALIDATOR 12
BILL ACCEPTOR
ROM
RAM
CPU
BILL INPUT DEVICE
MONITORING SWITCHES
CURRENCY/ QUANTITY DISPLAY
$1, $5, $10, $20 DISPLAY
COIN INPUT DEVICE
HOPPER / HOPPER MOTOR / HOPPER SWITCH
SLOT I/O BOARD
PROGRAMABLE COMMUNICATION INTERFACE
BUFFER
CREDIT METER DISPLAY
WIN METER DISPLAY
DISPLAY CONTROL DRIVERS
SLOT I/O BUFFER
FROM CONTROL DECODER
RAM
EPROM
ADDRESS DECODER
ADDRESS DECODER
BUFFER
BUFFER
CONTROL DECODER
PCI ENABLE
BUFFER ENABLE
CREDIT METER ENABLE
CUR / QUAN DISPLAY ENABLE
LED BLOCK ENABLE
WIN METER ENABLE
TO SLOT I/O BUFFER
DATA BUS
ADDRESS BUS
CONTROL BUS
CPU
SLOT MACHINE

FIG. 3

FIG. 4A


POWER UP
INITIALIZE SYSTEM PARAMETERS
120
CAN SYSTEM ACCEPT A BILL ?
122
NO
YES
RECONFIGURE BILL ACCEPTOR
128
COIN ACCEPTED ?
130
YES
NO
POLL BILL ACCEPTOR
136
BILL ACCEPTOR UP ?
138
NO
YES
BILL RECEIVED ?
140
NO
YES
RECEIVE BILL INFORMATION
142
END OF GAME ?
134
YES
NO
GO TO SLOT MACHINE GAME ROUTINE
132
SEND REJECT BILL MESSAGE
150
COIN ACCEPTED AFTER LOCK OUT ?
148
YES
NO
BILL VALIDATOR OK ?
152
NO
YES
DOOR OPEN ?
154
YES
NO
SEND REJECT BILL MESSAGE
156

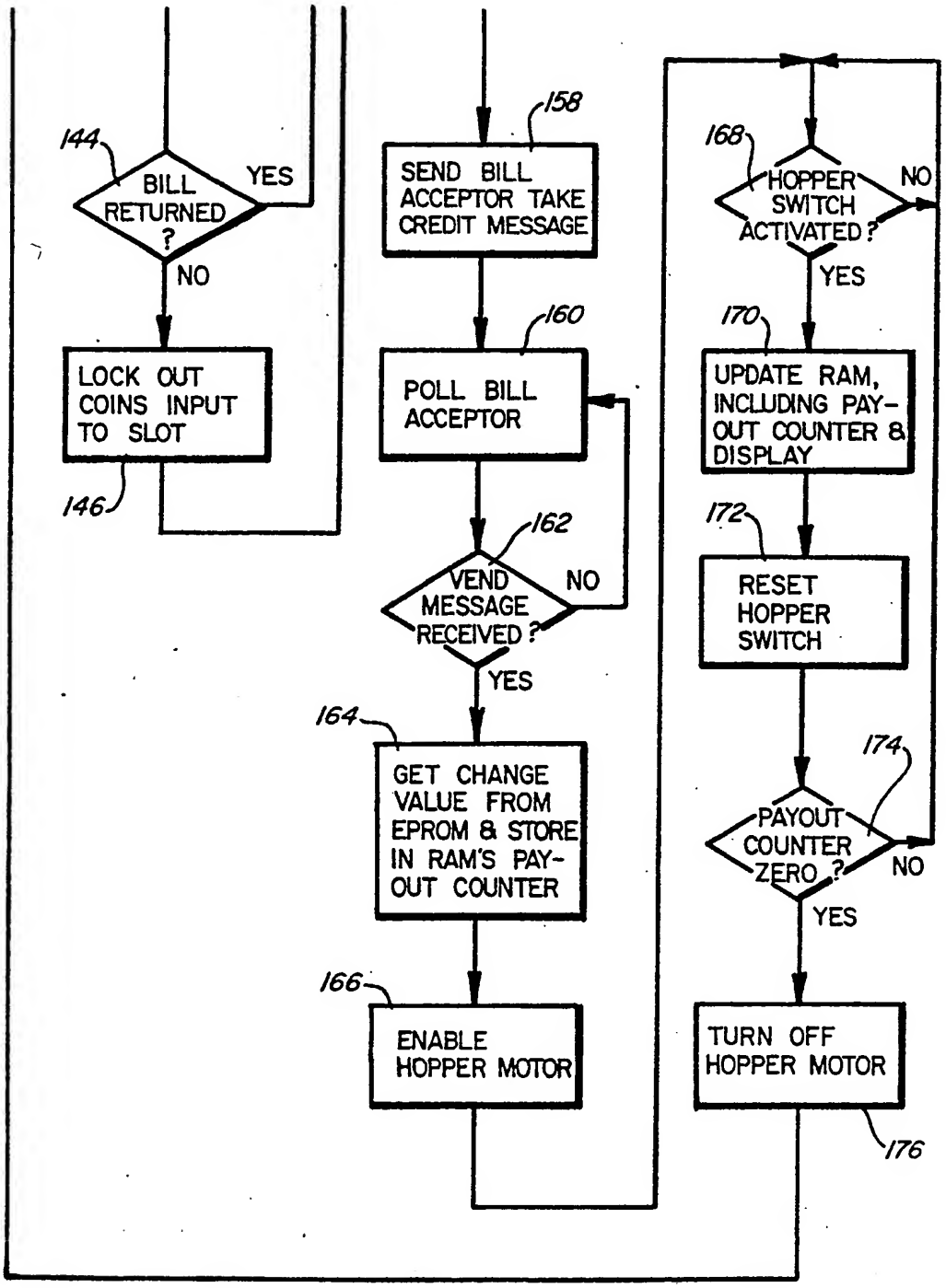

144
BILL RETURNED ?
YES
NO
LOCK OUT COINS INPUT TO SLOT
146
158
SEND BILL ACCEPTOR TAKE CREDIT MESSAGE
160
POLL BILL ACCEPTOR
162
VEND MESSAGE RECEIVED ?
NO
YES
164
GET CHANGE VALUE FROM EPROM & STORE IN RAM'S PAY-OUT COUNTER
166
ENABLE HOPPER MOTOR
168
HOPPER SWITCH ACTIVATED ?
NO
YES
170
UPDATE RAM, INCLUDING PAY-OUT COUNTER & DISPLAY
172
RESET HOPPER SWITCH
174
PAYOUT COUNTER ZERO ?
NO
YES
TURN OFF HOPPER MOTOR
176

FIG. 4B

SPECIFICATION

Bill validation and change system for a slot machine

Technical field

The present invention relates to a bill validation and change system for a gaming device such as a slot machine which contains a store of coins for paying out winners. More particularly, the present invention relates to such a bill validation and change system which accepts bills of different denominations and which pays out change for valid and acceptable bills from the same store of coins from which winners of the gaming device are paid.

Background of the invention

Typical gaming devices, such as a slot machine, accept coins of one denomination to play a game, the accepted coins being stored in a coin hopper contained in the machine. Winning game plays are determined randomly by the slot machine which pays out to the winners coins from the coin hopper.

Because typical slot machines accept coins of only a single denomination, a player must have that denomination of coin to play the slot machine game. Casinos having slot machines typically employ personnel to provide change for bills to players at the slot machines so that the players do not have to leave the machines if they wish to continue playing but do not have the correct denomination of coin. However, in large and busy casinos, slot machine players may encounter long waits for such change personnel to come by.

Known change machines are not particularly useful in providing change for slot machines since change machines typically accept bills of only one denomination and payout coins of various denominations. The slot machine player must thus have a bill of the particular denomination accepted by the change machine in order to use the machine. Even if the player does have a bill of the correct denomination, the change machine might still payout only one or two coins of the denomination acceptable by the slot machine so that after a few plays the player needs change again.

Summary of the invention

In accordance with the present invention, the disadvantages of prior slot machines and change machines as discussed above have been overcome. The slot machine bill validation and change system of the present invention is integral with the slot machine so that the player need not leave the slot machine when change is needed. Further, the system accepts bills of a plurality of denominations and pays out change for the bills only in coins of the denomination which may be accepted by the slot machine to enable players to play the maximum number of games for their bills without requiring additional change to be made.

The slot machine bill validation and change system of the present invention includes an input device which accepts coins input by a player to play a slot machine game. The coins are stored in a coin hopper which is controlled to payout coins to winners of the slot machine game and to make change for bills. Bills input to the system are received by a bill input device which determines the validity and denomination of an input bill and which is controllable to accept or reject bills. The slot machine bill validation and change system includes a master processor which determines winning game plays for the slot machine and whether change for a bill input to the system should be made; and which further controls the coin hopper to payout coins to winners and to make change for a bill. The master processor is coupled to a slave processor for communication therebetween. The slave processor is coupled to the bill input device for determining, in conjunction therewith, the denomination and validity of an input bill for communication to the master processor. The slave processor also controls the bill input device to accept bills for which change should be made as determined by the master processor and to reject invalid bills or valid bills for which change should not be made.

The master processor further monitors the number of coins in the coin hopper to prevent the acceptance of a bill by the input device when the coin hopper has less than a predetermined minimum number of coins. The master processor also monitors the coin input device to prevent change from being made after a coin has been accepted or a slot machine game is ongoing.

The system of the present invention allows change to be made for bills of a number of different denominations for the convenience of a slot machine player so that the player does not have to leave the machine or wait for casino personnel when change is needed. To further convenience the player, change is made only in coins having the same denomination as coins which are accepted by the slot machine to play a game.

These and other objects and advantages of the invention, as well as details of an illustrative embodiment will be more fully understood from the following description and from the drawings.

Brief description of the drawings

Figure 1 is a perspective view of a slot machine and bill validation unit according to the present invention;

Figure 2 is an enlarged view of the bill validation unit of Figure 1, a portion of which is cut away to show the passage of an accepted bill to a cash box contained in the unit;

Figure 3 is a block diagram illustrating the slot machine and bill validation unit of the present invention; and

Figures 4A and *4B* form a flowchart illustrating the change control provided by the slot machine's processor shown in Figure 3.

Best mode for carrying out the invention

The slot machine bill validation and change system of the present invention, as shown in Figures 1-3, includes a microprocessor based slot machine 10, to the housing of which is attached a bill validator unit 12. The slot machine includes three symbol bearing reels 14, 16 and 18 or a video display

representation thereof. To operate the device, a player inserts one or more coins or tokens into a slot 20 and pulls a handle 22. Pulling the handle will start the symbol bearing reels rotating. After a certain length of time, the reels will sequentially come to a stop and a certain combination of symbols will be displayed on the reels. If a combination of symbols matches one of a predefined combination, the slot machine's microprocessor or CPU 64 determines that a win has occurred and controls the dispensing of a specified number of coins from a coin hopper 26 through a payout chute 24.

To enable a player to store his winnings in the machine 10 while he continues to play, a credit button 30 is provided. If a player uses the credit button to store his winnings, the amount stored is displayed on a credit meter 32. When the player wishes to collect money stored by the machine as depicted on the credit meter 32, he depresses a collect button 34 and the money is paid out from the hopper 26 through the payout chute 24. A win meter 36 displays the number of coins played and amount of money won for the most recent winner.

As shown in Figures 1 and 2, the bill validator unit 12 includes a slot 40 through which bills are inserted when change is desired. The unit 12 includes a display 42 comprised of LED blocks which are controlled by the processor 64 of the slot machine 10. The LED block display 42 includes a bill denomination display 43 which depicts the various denominations of bills for which change can be made at a particular instant. The LED block display 42 also includes an arrow display 44 showing that change for a bill inserted into slot 40 will be paid out from the slot machine 10 to the left of the bill validator unit 12. The bill validator 12 also includes a second display 47 comprised of five LED, seven segment number displays, two of which depict the digits of a currency display 46 and three of which depict the digits of a quantity display 48. The currency display 46 shows the denomination of a bill input to the slot 40 whereas the quantity display starts at zero and is incremented by one as each coin is paid out to depict the total number of coins paid out from the coin hopper 26 as the coins are being output through the chute 24.

The validator unit 12 includes a microprocessor based bill acceptor 52. The bill acceptor 52, as shown in Figure 3, has a bill input device 54 for determining, in conjunction with the bill acceptor's processor 66, the validity and denomination of a bill inserted through the slot 40. The bill input device may include rollers or the like which engage a bill as it is inserted through the slot 40. The rollers are controlled by the bill acceptor's processor 66 to pass a bill 55 to a cash box 56 located directly below the bill acceptor 52 when the bill validator 12 accepts the bill, the rollers being controlled to reciprocate the bill out through the slot 40 when the validator 12 rejects the bill.

The bill validator unit 12 is a secure unit which requires a key to be inserted into a lock 58 to open a door 61 leading to the cash box 56. A second lock 60 is provided to secure the lid 62 of the validator unit 12. When opened, the lid 62 provides access to the bill acceptor 52. Monitoring switches 108, as shown in Figure 3, sense the presence of the bill acceptor 52 and the cash box 56. The switches 108 also signal the opening of the door 61 and lid 62 to alert the slot machine's processor 64.

The slot machine bill validation and change system, as shown in Figure 3, includes a master computer or central processing unit, CPU 64 contained in the housing of the slot machine 10 and a slave computer or CPU 66 contained in the bill acceptor 52. The CPU 66 of the bill acceptor 52 communicates with the CPU 64 through a programmable communication interface 68. The programmable communication interface 68 converts serial data received from the bill acceptor 52 on a line 70 to parallel data output on a data bus 72 coupled to the CPU 64. The programmable communication interface also converts parallel data received from the data bus 72 to serial data output to the bill acceptor 52 on a line 73.

The CPU 66 of the bill acceptor 52 is coupled to a RAM 76 and a ROM 78 through appropriate address and data buses, the RAM and ROM respectively storing data and software for controlling the operation of the bill acceptor 52. Similarly, the CPU 64 is coupled to an EPROM 80 through the data bus 72 and an address bus 74, the EPROM 80 storing software which determines how the slot machine game is played and software needed by the slot machine 10 for communication with the bill validator 12. The slot machine's CPU 64 is also coupled to a RAM 82 through the data bus 72 and address bus 74. The RAM 82 stores data used for book-keeping purposes and data representing various parameters generated for the slot machine game. In particular, the RAM 82 stores data which represents among other things, the quantity of change vended, i.e. the number of coins paid out from the coin hopper 26 to make change for an accepted bill; the total number of coins contained in the hopper 26; and the total number of coins paid out by the slot machine 10 to provide change and winning payouts. The RAM 82 also includes a storage location which forms a payout counter as discussed in detail below with reference to Figures 4A and 4B. The EPROM 80 and the RAM 82 are enabled by outputs on respective lines 86 and 88 from an address decoder 90. The address decoder 90 decodes addresses output from the CPU 64 on the address bus 74, the addresses being coupled to the decoder through a buffer 92.

The display meters for the slot machine and bill validator, including the credit meter 32, the win meter 36, the currency/quantity display 47 and the bill denomination and arrow display 42, are driven by a number of display control drivers 94. The display control drivers 94 for the credit meter 32, currency/quantity display 47 and bill denomination and arrow display 42 are enabled by outputs on respective lines 96, 98 and 100 from an address decoder 102. The address decoder receives addresses from the bus 74 through a buffer 104 and decodes the buffered addresses to enable a particular one of the display control drivers 94, the programmable communication interface 68 or a buffer 106 coupled to the monitoring switches 108 of the bill validator unit 12.

The slot machine 10 further includes a control decoder 110 which is responsive to control signals from the CPU 64 on bus 112 to enable either the display control driver 94 for the win meter display 36 or to enable a slot machine input/output buffer 114. The slot machine input/output buffer 114 couples data to and from the data bus 72 and a slot machine input/output board 116 which is coupled to the coin hopper 26 and a coin input device 118. The coin input device 118 is coupled to the coin slot 20 to receive coins of one denomination which are input through the slot 40. The coin input device 118 determines the validity of coins and accepts or rejects the coins, the device 118 being coupled to the coin hopper 26 to store valid and accepted coins therein. The device 118 further includes a switch which is actuated in response to each accepted coin as the coin passes to the coin hopper for storage as discussed below. Each time the coin input switch is actuated, a signal is communicated to the data bus 72 from the input device 118 so that the CPU 64 may update the RAM 82.

The hopper 26 is controlled by the CPU 64 through the slot input/output buffer 114 and the slot input/output board 116 to payout coins through the payout chute 24 for winning game plays. The hopper 26 includes a switch which is actuated each time a coin is paid out from the hopper. Each time the hopper switch is actuated, a signal is communicated to the data bus 72 from the hopper 26 indicating the payout of a coin so that the CPU 64 may update the RAM 82 for winning game payouts and change payouts as discussed below.

The operation of the bill validation and change system will now be described with reference to the flowchart of Figures 4A and 4B. Upon power up of the system, the system parameters are initialized at block 120. These parameters include the hopper cutoff values for each bill denomination which can be accepted by the bill validator unit 12. The hopper cutoff values represent the least number of coins needed in the hopper 26 to allow change to be dispensed for a particular bill denomination. For the bill validator unit 12 illustrated in Figures 1 and 2, hopper cutoff values are set for bills of the following denominations: $1.00, $5.00, $10.00 and $20.00.

After the system parameters are initialized, at block 122, the CPU 64 of the slot machine determines whether the system can accept a bill. The system cannot accept a bill if any one of the following conditions exist: (1) a game is currently being played such that the handle 22 of the slot machine has been pulled; (2) a coin has been inserted so that a game is about to be played; (3) a door on either the slot machine 10 or the bill validator unit 12 is open; (4) the slot machine 10 is locked up on a win; (5) the number of coins in the hopper is less than the cutoff value for the smallest bill denomination which may be accepted by the bill validator unit 12; (6) the system is out of order; and (7) the slot machine is in a tilt. If one or more of these conditions exists, the CPU 64 will prevent the acceptance of a bill by the validator 12. If any one of conditions (3) and (5)-(7) exists, the CPU 64 will further control the coin input device 118 through the slot I/O buffer 114 and the slot I/O board 116 to reject any coins input to the slot machine 10 and will instruct the bill acceptor 52 through the programmable communication interface 68 to clear the bill denomination display 43 so that the LED blocks forming each of the bill denominations are not lit. The CPU 64 then returns to block 122.

If the system can accept a bill as determined at block 122, the CPU 64 reconfigures the bill acceptor 52 at block 128 by instructing the bill acceptor as to what bill denominations are acceptable. More specifically, the CPU 64 checks the number of coins presently stored in the coin hopper 26 and compares this number to the hopper cutoff value for each bill denomination. If the number of coins in the hopper is greater than or equal to the cutoff value for a particular denomination, the CPU 64 instructs the bill acceptor, at block 128, that that particular bill denomination is acceptable. Next, at block 130, the CPU 64 determines whether a coin has been accepted by the coin input device 118. If a coin has been accepted, the CPU 64 executes a slot machine game routine at block 132. At the end of a slot machine game as determined at block 134, the CPU 64 returns to block 122 to determine whether the system can now accept a bill. If it was determined at block 130 that a coin was not accepted, the CPU 64 polls the bill acceptor 52 at block 136 and at block 138 determines whether the bill acceptor 52 is operating. If the bill acceptor is up and operating as determined at block 138, the CPU 64 determines, at block 140, whether a bill has been received by the bill acceptor 52.

When the bill acceptor 52 receives a bill input through slot 64, the bill acceptor responds to a poll from the CPU 64 with a busy message. At this time, the bill acceptor 52 checks the validity and denomination of the received bill to determine if the bill is one which may be accepted. After determining the validity of the bill and whether the bill has an acceptable denomination as dictated by the CPU 64, the bill acceptor 52, in response to a poll by the CPU 64, transmits bill information to the slot machine's CPU 64. At block 142, the CPU 64 receives the bill information from the bill acceptor 52, the information including either a "note returned" message if the bill is invalid or has a denomination which cannot be accepted, or the denomination of an acceptable bill being held by the bill acceptor 52.

If a valid bill has been received by the bill acceptor 52 and the bill has not been returned as determined by the CPU 64 at block 144, the CPU 64, at block 146 instructs the coin input device 118 to lock out coins input to the slot machine 10. The coin input device 118 includes a device for detecting the validity of a coin, the detecting device rejecting any coin determined to be bad and also rejecting coins if instructed to do so by the CPU 64. The coin validity detecting device allows coins to pass to the coin hopper if a coin is determined to be valid and may be accepted. Downstream of the coin validity detecting device, is a switch which senses the presence of an accepted coin as it passes to the coin hopper. The CPU 64 is responsive to the actuation of the switch to update values in the RAM 82 which represent the

present number of coins in the coin hopper 26. The CPU 64 is also responsive to actuation of the switch to determine at block 148 whether a coin has been accepted after the lock out command was issued to the coin input device 118. If a coin was accepted after lockout, the CPU 64, at block 150 sends a "reject bill" message to the bill acceptor 52 and at block 132 executes the slot machine game routine. If a coin has not been accepted after lockout as determined at block 148, the CPU 64 checks the monitoring switches 108 to determine at block 152 whether the bill acceptor 52 and the cash box 56 are in place and at block 154 whether any doors are open. If the monitoring switches 108 indicate that either the bill acceptor 52 or cash box 56 has been removed or that a door is open, the CPU 64 sends a reject bill message to the bill acceptor 52 at a block 156.

If the monitoring switches 108 indicate that the system is alright, at block 158, the CPU 64 sends to the bill acceptor 52 a "take credit" message. The bill acceptor 52 responds to a "take credit" message by accepting the received bill and passing the bill to the cash box 56. At block 160, the CPU 64 again polls the bill acceptor 52 for a vend message which indicates that a bill has passed to the cash box 56. When the vend message is received from the bill acceptor 52 as determined by the CPU 64 at block 162, the CPU 64, at block 164, retrieves from a table stored in the EPROM 80 the change value for the denomination of the bill accepted and stores the change value in the payout counter register of the RAM 82. The change value represents the number of coins required to make change for the accepted bill. After initializing the payout counter at block 164, the CPU 64, at block 166, enables the hopper motor to cause the hopper 26 to release a coin through the payout chute 24. The hopper 26 includes a switch, as discussed above, which detects each coin paid out from the hopper. The CPU 64 monitors the hopper switch to determine whether it has been actuated or not. When the hopper switch has been actuated, indicating that a coin has been paid out from the hopper, as determined at block 168, the CPU 64, at block 170, updates the RAM 82 and the quantity display 48. More specifically, at block 170, the CPU 64 increments the payout counter by one; and increments the change vended and total slot machine output values stored in the RAM 82. The CPU 64 further increments the RAM location corresponding to the quantity display 48 to cause the display to show the number of coins presently paid out. The CPU 64, at block 172, resets the hopper switch and at block 174 determines whether the payout counter has reached zero. If the payout counter has not reached zero, the CPU 64 waits for the hopper switch to be actuated again to update the RAM 82 and quantity display 48 as the next coin is paid out. When the payout counter reaches zero, as determined at block 174, the CPU 64 at block 176 turns off the hopper motor and returns to block 122.

The bill validation and change system of the present invention as described above allows change to be made for bills of a number of different denominations for the convenience of a slot machine player so that the player does not have to leave the machine or wait for a casino personnel when change is needed to continue playing the game. To further convenience the player, change is made only in coins having the same denomination as coins which are accepted by the slot machine to play a game. It is noted that the term coin as used herein is meant to encompass tokens which may be issued by a casino and represent a money value for which a real coin is not made or not readily available.

CLAIMS

1. A gaming device including means for accepting and storing coins to play a game, means for determining a winning game play, means for paying out coins for a winning game and a currency bill changing means, which currency bill changing means comprises:

means for receiving, identifying and validating currency bills;

means for monitoring the number of coins in the coin storage means;

means responsive to the monitoring means and the bill receiving, identifying and validating means, for determining if a currency bill can be accepted based on the validity and value of that bill and the number of coins in the coin storage means; and

means controlling the paying out means in response to the win determining means and to the bill acceptance determining means, for paying out coins as game winnings or as a change for an accepted bill, as appropriate.

2. A gaming machine according to claim 1, further comprising means responsive to the bill acceptance determining means for rejecting bills determined to be invalid or unacceptable and for retaining bills determined to be valid and acceptable.

3. A gaming machine according to either preceding claim, wherein the means for receiving, identifying and validating currency bills is capable of receiving bills of a plurality of denominations and of identifying and validating each of those denominations of bills.

4. A gaming machine according to claim 3, wherein the means for receiving, identifying and validating currency bills further comprises means for displaying the denomination of a received and validated bill determined to be acceptable.

5. A gaming device according to any preceding claim, wherein the monitoring means includes means for storing data representing the number of coins inserted into the storage means, and means responsive to the payout control for decrementing that data in response to each coin paid out as game winings or as change for an accepted bill.

6. A gaming device according to any preceding claim, wherein the means for controlling the paying out means comprises:

a payout register for receiving a number corresponding to the number of coins to be paid out;

means for loading the payout register with a number corresponding to game winnings or change to be given for an accepted and validated currency bill;

means responsive to each coin being paid out

from the coin store for signalling the payment of that coin;

means responsive to the signalling means for decrementing the number held in the payout register for each coin paid out; and

means responsive to the number held in the payout register for enabling the paying out means when a positive number is held in the payout register and for inhibiting the paying out means when the number in the payout register has been decremented to zero.

7. A gaming machine according to claim 6, further including means responsive to the payout control means for displaying the number of coins paid out from the coin store.

8. A gaming machine according to claim 7, wherein the display means is responsive to the signalling means for incrementing the display means each time payment out of a coin is signalled, to display a running count of the coins paid out.

9. A gaming device according to any preceding claim, further comprising means for preventing game play after a bill has been received and accepted by the currency bill changing means, until change has been given for that bill.

10. A gaming device according to any preceding claim, further comprising means for determining whether a game is in progress and means controlling the currency bill changing means for preventing acceptance of a currency bill if a game is in progress when the bill is received.

11. A gaming device according to claim 10, wherein the means controlling the currency bill changing means prevents acceptance of a currency bill if a coin has been accepted as payment or part payment of a game before the bill is received.

12. A gaming device according to any preceding claim, wherein the means for accepting and storing coins and the means for paying out coins are arranged to accept, store and pay out coins of a single denomination only.

13. A gaming device substantially as described herein with reference to the drawings.

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